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BRIEF FOR APPELLEE DIRECTOR OF THE UNITED STATES PATENT AND TRADEMARK OFFICE

United States Court of Appeals
for the Federal Circuit

04-1074
(Serial No. 09/136,483)

IN RE SUJEET KUMAR, HARIKLIA DRIS REITZ, XIANGXIN BI AND NOBUYUKI KAMBE

Appeal from the United States Patent and Trademark Office,
Board of Patent Appeals and Interferences

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May 5, 2004

Representative claims 1 and 19:

1. A collection of particles comprising aluminum oxide, the collection of particles having

(i) an average diameter of primary particles from about 5 nm to about 500 nm and

(ii) less than about one in 10^6 particles have a diameter greater than about three times the average diameter of the collection of particles.

19. A collection of particles comprising aluminum oxide, the collection of particles having

(i) an average diameter from about 5 nm to about 500 nm and

(ii) a distribution of particle sizes such that at least about 95 percent of the particles have a diameter greater than about 40 percent of the average diameter and less than about 160 percent of the average diameter.

A504, A506 (lower roman numerals added).

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STATEMENT OF RELATED CASES

The Director of the United States Patent and Trademark Office is not aware of any other appeal from the Board of Patent Appeals and Interferences in connection with application Serial No. 09/136,483 that has previously been before this or any other court. The Director is also unaware of any other cases pending in this or any other court that will directly affect or be directly affected by this Court's decision in the pending appeal.

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STATEMENT OF THE ISSUE

The invention relates to a collection of extremely small aluminum oxide particles used for, e.g., polishing hard materials. Representative claims 1 and 19 each define the particles as having two size limitations: (i) average diameter and (ii) particle size distribution. It is undisputed that Rostoker discloses aluminum oxide particles having average diameters within the average diameter range of claims 1 and 19 (which are the same). The primary issue on appeal is whether substantial evidence supports the Board's findings that the Rostoker patent discloses aluminum oxide particles having a particle size distribution that overlaps

Kumar's claimed ranges, thus rendering Kumar's claims obvious.

STATEMENT OF THE CASE

Appellants, Sujeet Kumar, Hariklia Dris Reitz, Xiangxin Bi and Nobuyuki Kambe ("Kumar") filed U.S. Patent Application Serial No. 09/136,483 ('483 application), entitled "Aluminum Oxide Particles," in which claims 1-3, 5-16 and 19-22 were found to be unpatentable as obvious over U.S. Patent No. 5,389,194 to Rostoker et al. ("Rostoker"), alone or in view of U.S. Patent No. 5,697,992 to Ueda et al. ("Ueda"). Br. at 5, 6.[1] Kumar unsuccessfully attempted to rebut the examiner's rejections by arguing that: (1) Rostoker failed to disclose the claimed aluminum particle size distribution; and (2) Rostoker did not enable one of skill in the art to produce aluminum particles having the claimed size distribution. A460-461.

Kumar timely filed an appeal brief to the Board of Patent Appeals and Interferences ("Board") reiterating the arguments made to the examiner. The Board reversed a separate rejection of claims 17 and 18, but upheld the rejection of claims 1-3, 5-16 and 19-22, finding Rostoker was an enabled reference that disclosed the claimed particle average diameter (which was undisputed), as well as

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[1] Citations to Kumar's Brief will be referred to as "Br. at __," and citations to the Joint Appendix as "A__."

the claimed particle size distribution. A1-16. Kumar now appeals the Board decision to this Court.

STATEMENT OF THE FACTS

A. The Claimed Invention

Kumar's invention concerns extremely small aluminum oxide particles that have an average diameter, ranging from about 5 - 500 nanometers (nm). The claimed particles also have a narrow particle size distribution. A31-32. These "submicron" or "nanoscale" particles are used for highly accurate polishing of, for example, electronic components such as semiconductor wafers. A04, A31. Their narrow particle size distribution allows for improved polishing characteristics. A31, A34.

It is important to maintain a uniform particle size distribution, and especially to prevent particles much larger than the preferred average particle size, in order to ensure optimum polishing and avoid damaging the surface being polished. A04; A605, col. 7, lines 55-61. Kumar's analogy using balls (Br. at 9) is an apt one. For example, although both collections of the following balls (1) Softballs/Baseballs/Tennis Balls, or (2) Basketballs/Baseballs/Golf Balls, might have the same or similar average diameter (close to a Baseball), group (1) has a narrower size distribution (particle size distribution) than group (2).

Representative claims 1 and 19 read as follows:

1. A collection of particles comprising aluminum oxide, the collection of particles having

> (i) an average diameter of primary particles from about 5 nm to about 500 nm and
>
> (ii) less than about one in 10^6 particles have a diameter greater than about three times the average diameter of the collection of particles.

19. A collection of particles comprising aluminum oxide, the collection of particles having

> (i) an average diameter from about 5 nm to about 500 nm and
>
> (ii) a distribution of particle sizes such that at least about 95 percent of the particles have a diameter greater than about 40 percent of the average diameter and less than about 160 percent of the average diameter.

A02, A504, A506 (lower roman numerals added).

In one claimed embodiment, the narrow distribution is limited such that approximately only one in one million particles of the collection of particles will have a diameter larger than three times (3x) the average particle diameter. A02, A504. In another claimed embodiment, the narrow distribution is limited such that approximately 95% of the particle diameters of the collection of particles fall within the range of 40% to 160% of the average particle diameter. A02, A506. Thus, the claims have two size limitations, (i) an average diameter limitation (AD)

and (ii) a particle size distribution limitation (PD). Note: particle size distribution (PD) is dependent upon average diameter (AD). The charts below summarize the two limitations.

Claim	Average Diameter (AD)	Particle Size Distribution (PD)
1	About 5 nm to 500 nm	Approx. less than 1 in 10^6 particles have a diameter three times (3x) the average diameter (AD).
19	About 5 nm to 500 nm	95 % of the particles have a diameter greater than (>) 40 % of the AD and less than (<) 160 % of the AD

Thus, Kumar claims an average particle diameter ranging between about 5 - 500 nm and describes a minimum/maximum particle diameter range (dependent upon average diameter) from approximately 2 nm to 1500 nm (2 nm = [5 nm x 40%] (claim 19) to 1500 nm = [500 nm x 3] (claim 1)).

For example, if the average diameter (AD) is 100 nm, then according to Claim 1, less than 1 in a million (10^6) particles will be larger than 300nm. Shown graphically[2]:

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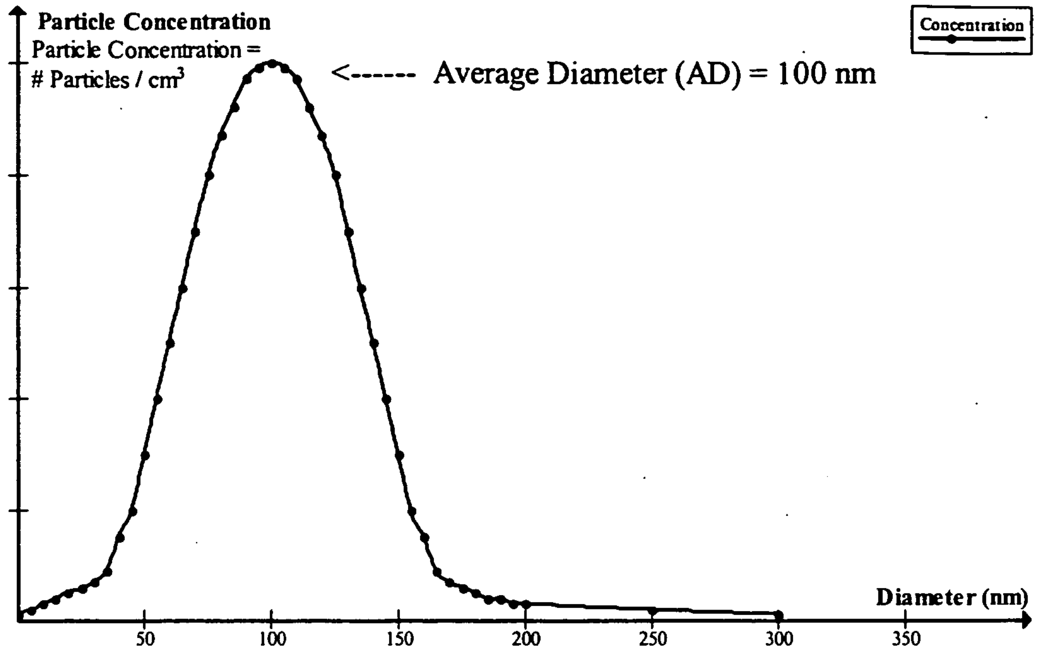
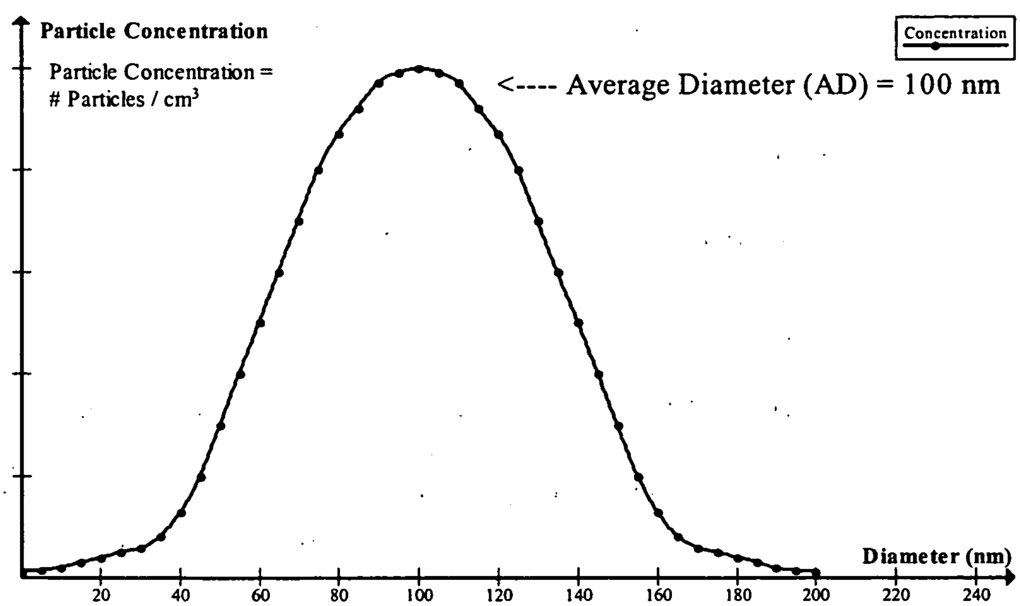
[2] The graphical representations included in this brief are included to provide a simplified illustration of the particle size ranges discussed for a given particle average diameter (size). These graphs are not the result actual experimentation, nor were they part of either the Rostoker reference or the Kumar application.



Similarly, according to Claim 19, for a given AD of 100 nm, 95% of the particles are between 40% and 160% of the AD, i.e., 40 nm - 160nm. Shown graphically:



B. The Prior Art - Rostoker

Kumar's claims 1 and 19 are rejected over Rostoker (U.S. Patent No. 5,389,194 to Rostoker et al.)[3]. The Board relied on both the specification and claim 10 of Rostoker in its rejection. Claim 10 of Rostoker states:

> 10. Method of polishing a substrate, comprising:
> polishing the surface of a semiconductor substrate with a medium of aluminum oxide particles having (i) a preferred size "X" nanometers, (ii) a range of sizes within "Y" nanometers of "X" and a percentage "Z" of particles in the alpha phase, wherein:
>
> (i) "X" is 10-100 nm;
>
> (ii) "Y" is "P" percent of "X", where "P" is no greater than 50%; and
>
> "Z" is at least 50%; and
>
> cleaning the surface of the semiconductor substrate with a cleaning solution consisting essentially of phosphoric acid and hydrofluoric acid.

A607 (lower case roman numerals added).

Rostoker is directed to methods and products for polishing semiconductor substrates. Rostoker describes aluminum oxide nanoparticles having a preferred

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[3] Kumar's claims 1-3, 5-16 and 19-20 were rejected over Rostoker alone or in combination with Ueda. A108-A121. However, since the only issues now on appeal were whether Rostoker disclosed the claimed particle size distribution, and whether Rostoker is enabling, Rostoker will be the only reference discussed. See Br. at 6.

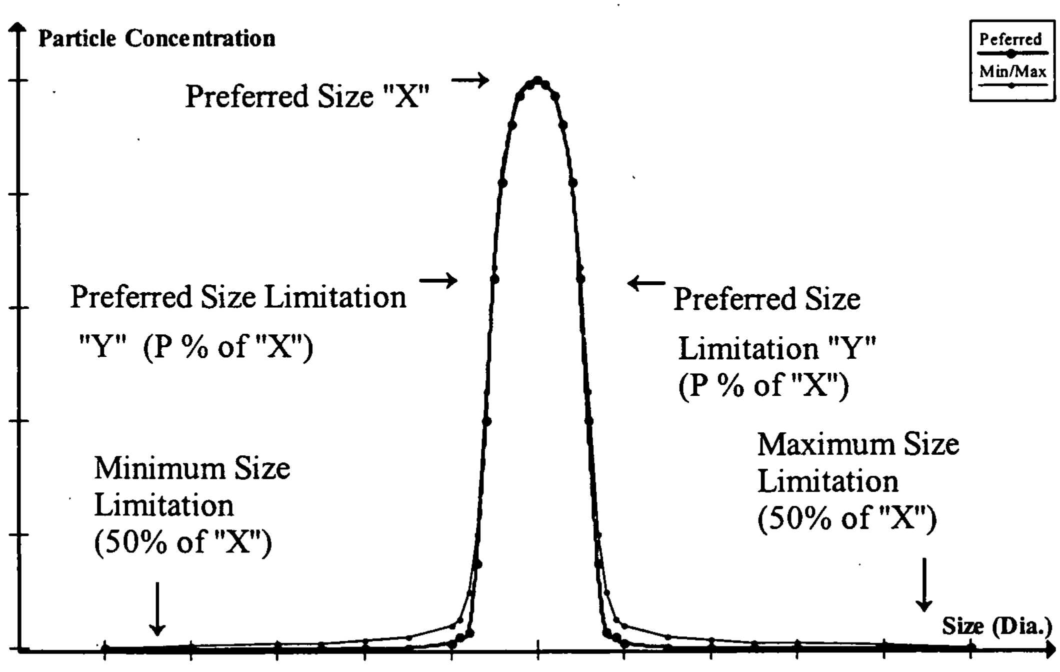
size (average diameter (AD)), "X," ranging from 10 nm - 100 nm, but preferably no more than 50 nm. Rostoker also describes a preferred range of sizes (particle distribution (PD)), "Y," within which its aluminum oxide particles are contained for improved polishing. "Y" is a percentage of the "X" value, limited to no more than 50% of "X." A605, A607 (claim 10). Specifically, Rostoker describes a polishing slurry including aluminum oxide particles that have a preferred size ("X" nanometers), where the distribution of the particle sizes is controlled to within a preferred number of nanometers ("Y") of the preferred size ("X"). A605.

The preferred value for "X" is 10-100 nm, and is preferably no greater than 50 nm. A605, col. 7, lines 4-15, see also A607 (claim 10). The value of "Y" is approximately "P" percent of "X," and is preferably no greater than 50% of "X" to ensure a narrow Gaussian distribution of particle sizes about "X." A605, col. 7, lines 4-15, see also A607 (claim 10). Therefore the maximum preferred range of particle sizes disclosed by Rostoker is 5 nm - 150 nm [10 nm - (10 nm x 50% = 5 nm) to 100 nm + (100 nm x 50% = 150 nm)], depending on the specified preferred size.

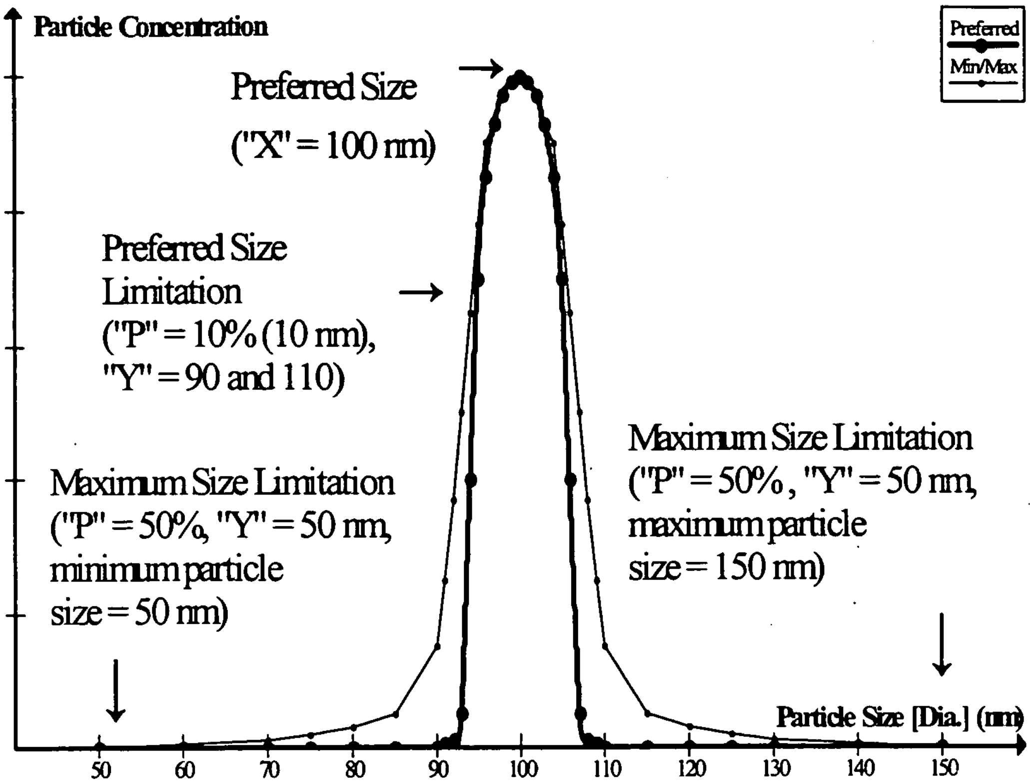
Rostoker Claim 10

Preferred Size	Preferred Particle Size Range
"X" = 10 nm to 100 nm	"Y" = ("P") x ("X") and "P" is no greater than 50 % (≤ ("X") x 50%). Thus, the maximum particle size range is: 5 nm - 150 nm (depending upon preferred size).

For example: For a collection with a preferred size, "X," (AD) of 10 nm, when "Y" = 50%, the particle size range (PD) is 5 - 15 nm, if "Y" = 10% then the PD range is 9 - 11 nm. The values of "X" and "Y" are also presented graphically below. This graph shows both the preferred value of "Y" (which is "P" % of "X") and the minimum/maximum values of "Y" (less than or equal to 50% of "X").



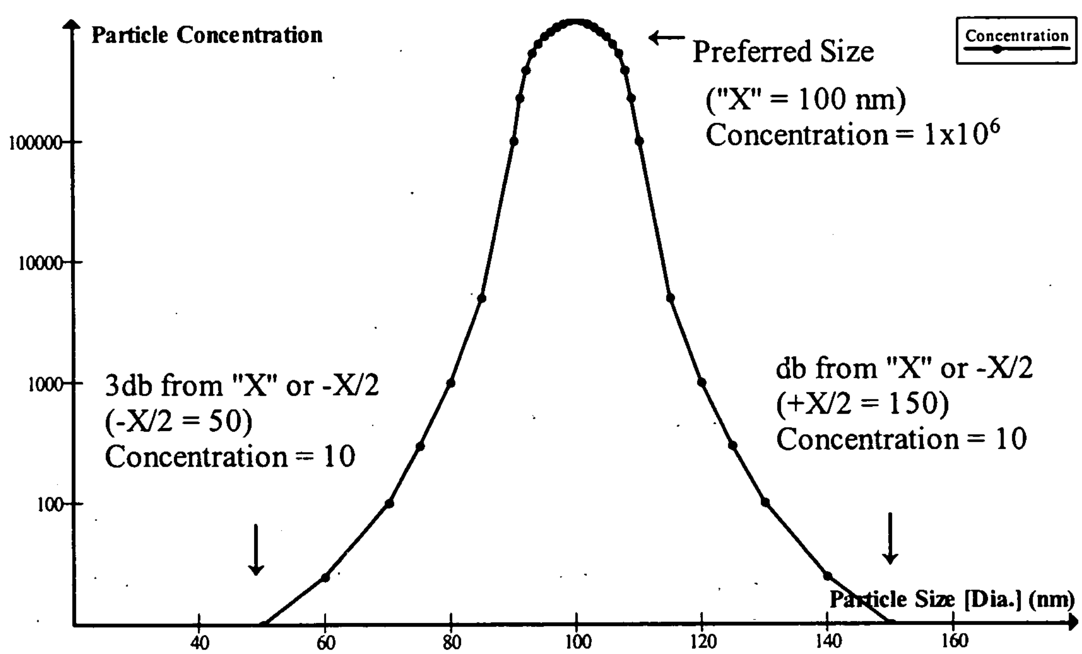
For example, Rostoker explicitly discloses an aluminum oxide polishing product wherein the aluminum oxide particles have an average particle size (diameter) of 10 nm that is controlled to within 10% (plus or minus (+/-) 10%) of the particle size (approx. +/- 1 nm). A606, col. 10 lines 5-11. The Board expanded upon this example, finding that Rostoker discloses aluminum oxide particles having a maximum distribution of 10 nm plus or minus 50% or 5 nm (10 nm ± 5 nm = 5-15 nm). A013. In a second example the Board found Rostoker explicitly discloses aluminum oxide particles having a preferred average size of 100 nm controlled to within 10% (approx. ± 10 nm) (100 ± 10nm = 90-110 nm), with a maximum distribution of 100 nm ± 50% or 50 nm (100 ± 50 nm = 50-150 nm). This is shown graphically below, where the inside graph represents the preferred "Y" value (90 - 110 nm), and the outside graph represents the minimum/maximum "Y" values (50 - 150 nm).



Rostoker also describes a quality factor "Q," which is a measure of particle size distribution, and that is inversely proportional to "Y." A605, col. 7, lines 17-26. Q is the ratio of particle concentration at desired size "X" (see above) and at another size that is 3 decibels (3db) from the X value. A605, col. 7, lines 20-22. This value is plus or minus X/2, as will be explained below.

To find a value that is 3db from X (we can refer to this value as "A"), you must solve the logarithmic function [10 log (X/A)=3db]. Because log (X/A) = 3/10 = 0.3, (X/A) = 10^0.3 =2. So the value A is one half the value X. Put simply, because 10 log 2 = 3db, this size value is -X/2, +X/2.

So, the ratio of particle concentrations is determined by the concentration at X and at ± X/2. This value can range from 10 - 10,000. A605, col. 7, lines 17-26. The ratio is determined by dividing the particle concentration at "X" by the particle concentration at ± X/2, e.g. if the particle concentration at "X" is 1×10^6 particles per cm^3, and the particle concentration at ±X/2 is 10 particles per cm^3, then the ratio would equal 1×10^5 (10,000). For example, where the preferred average particle size, "X," is 100 nm and the concentration of particles at the preferred size is 1×10^6 particles per cm^3, the size value 3db from "X" is 50 nm (-X/2) or 150 nm (+X/2) and the concentration of particles at these sizes is 10 particles per cm^3. The ratio, "Q," is 10,000. This is displayed graphically below.



Maintaining a high "Q" range, i.e., a narrow particle size distribution, ensures improved polishing because larger particles tend to scratch the surface to be polished and small particles merely dilute the slurry. A605, col. 7, lines 55-61.

C. The Board Decision

The Board affirmed the 35 U.S.C. § 103 rejection of claims 1-3, 5-16 and 19-22 based on Rostoker alone or in combination with Ueda as to some of the dependent claims.[4] A03. The Board selected claims 1 and 19 as representative. A05; 37 C.F.R.§ 1.192(c)(7). Because Ueda was not part of the rejection for these representative claims, it will not be discussed.

The Board concluded that the examiner had made out a *prima facie* case of obviousness with respect to Rostoker. A08, A09. Kumar's claim 1 and 19 both claim aluminum oxide particles having two size limitations: (i) a limitation as to the average size or diameter (AD) and (ii) a limitation as to the particle size distribution (PD). The Board found, and Kumar concedes, that Rostoker discloses ranges overlapping the AD claimed ranges. A490, 2nd paragraph; A05. Thus the only limitation in dispute is the PD range and whether Rostoker discloses it.

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[4] The Board reversed the 35 U.S.C.§ 103 rejection of claims 17-18 over U.S. Patent No. 5,064,517 to Shimo ("Shimo"). All other grounds of rejection set out by the examiner were withdrawn. A03. Thus, Kumar is entitled to method/process claims directed to the process for producing his claimed particles.

The Board gave Kumar's claims their broadest reasonable interpretation and found that Kumar's claim 1 "as drafted, [did] not preclude the presence of a tail." A07.[5] The Board also found that claims 1 and 19 were "not in any way limited to" Kumar's preferred laser pyrolysis method for producing the claimed collection of particles. A07. In its decision on request for rehearing, the Board modified its claim construction of Kumar's claim 1, finding that it did indeed preclude a tail (A764), but that this did not affect its overall obviousness conclusion. Id.

Specifically, the Board found that even though Kumar's claim 1 precluded a tail (had no particles larger in size than a cut off value much larger than the average diameter), Rostoker disclosed particle collections that also did not include a tail. A07-08. The Board explained that "Rostoker discloses a collection of particles having both the sizes and distribution within appellants' claimed ranges . . .which do not include a tail." A07-08. In making this finding, the Board referenced the examiner's answer (A683-684), the Rostoker patent (A605), and its own sample calculations using Rostoker's criteria (A13). Additionally, the Board

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[5] The "tail" referenced by Kumar and the Board means that the collection of particles could include a large number (concentration) of particles that are much larger than an average particle diameter. This is shown as an elongation in the particle diameter (size) graph at larger diameters which looks like a "tail" on the end of the graph. This is the so-called "tail" that is discussed at length in Kumar's brief (e.g., Br. at 8-9) as well as in the Board's decisions (e.g., A08-09).

explained that Rostoker discloses a quality factor "Q" that would mean to one of skill in the art that "Rostoker's collection of particles have an extremely uniform particle size." A09. The Board found that Rostoker's particle size distribution, therefore, would not include a large tail as asserted by Kumar. A08-09.

The Board further found that Rostoker was an enabled reference. A767-768. In determining that Rostoker was an enabling reference, the Board found that "Rostoker teaches a collection of particles having sizes and distributions within [Kumar's] claimed ranges . . . and [Rostoker's] claims as drafted are not limited to particles produced by a particular method." A09. The Board also carefully evaluated the Kambe declaration submitted by Kumar in support of his argument that Rostoker is non-enabling.

The Board found that the Kambe declaration (A635-640) did <u>not</u> rebut the teaching of Rostoker of particle sizes and distributions that were overlapped by Kumar's claimed particle size ranges and distributions. A09. The Board found that the Kambe declaration was submitted to support the position that "other approaches for the formation of [Kumar's] claimed invention are not available." The Board found, however, that Rostoker's "claims as drafted are not limited to particles produced by a particular method." A09. Moreover, the Board found that the assertion in the Kambe declaration that no method (other than Kumar's) exists

to produce aluminum oxide nanoparticles with a size of less than 500 nm and a narrow particle size distribution was contrary to the express teaching of Rostoker and were unsupported by any evidentiary showing. A09, referencing A685-686. Thus, the Board concluded that "[w]e agree with the examiner that [the Kambe] declaration is unpersuasive since it fails to address the examiner's prima facie showing of obviousness." A09.

On request for rehearing, the Board denied rehearing and reiterated that "Rostoker discloses a polishing composition comprising a collection of particles which meet the limitations recited in claims 1 and 19. Further Rostoker claims [(see claim 10)] a method of polishing a substrate using a medium of aluminum oxide particles having sizes and a distribution which overlap those of the [Kumar] invention." A767. Based upon these disclosures the Board also explained each patent claim is presumed valid under 35 U.S.C. § 282, that a reference is presumed operable, and the burden is on the appellant to rebut these presumptions. The Board found that Kumar failed to overcome these presumptions. A767-768.

The Board also reviewed, but decline to consider the Singh declaration (A743-A750). The Board declined to consider the declaration because it was presented with Kumar's Request for Rehearing, after the appeal to the Board was already decided. Even though the Singh declaration was untimely filed, the Board

did review it and addressed its contents. The Board found that the Singh declaration did not rebut the particle sizes and distributions taught by Rostoker; however, the Board declined to consider the declaration further, citing 37 C.F.R.§ 1.195, and stating that "[w]hile expert declarations are an appropriate form of rebuttal evidence, we decline to consider Professor Singh's declaration since appellants have failed to provide a showing of good and sufficient reasons as to why this declaration was not earlier presented." A766. Accordingly, the Board affirmed the examiner's rejection of claims 1-3, 5-16 and 19-22 under § 103, based on its conclusion that Rostoker disclosed the claimed particle size distribution and was an enabling reference.

SUMMARY OF THE ARGUMENT

Kumar claims aluminum oxide nanoparticles having two size limitations: (i) average particle size and (ii) particle size distribution. Rostoker also discloses and claims an aluminum oxide product with two particle size limitations: (i) preferred particle size and (ii) preferred particle size distribution. It is undisputed that Rostoker discloses a particle size (average diameter) that is overlapped by Kumar's claimed average diameter. Rostoker also discloses a particle size distribution that is overlapped by Kumar's claimed particle distribution. Rostoker discloses this distribution because it sets out a particle size range from 5 nm to 150

nm (dependent on preferred size), while Kumar describes a collection of particles ranging in size from 2 nm - 1500 nm (dependent on average diameter and the particular claim limitation). Thus, substantial evidence supports the Board's findings that Rostoker discloses aluminum oxide particles with the characteristics claimed by Kumar, and that Rostoker is an enabled prior art patent which renders obvious Kumar's claimed invention.

ARGUMENT

A. Standards of Review

Appellant bears the burden of proving that the Board committed reversible error. See In re Gartside, 203 F.3d 1305, 1315-16 (Fed. Cir. 2000).

Obviousness is a legal question based on underlying factual findings. See In re Mayne, 104 F.3d 1339, 1341 (Fed. Cir. 1997). Determining what a reference teaches is a factual inquiry. See Para-Ordnance Mfg. v. SGS Importers Int'l, Inc., 73 F.3d 1085, 1088 (Fed. Cir. 1995). Enablement is also a question of law based on underlying factual determinations. See Crown Operations Intern., Ltd. v. Solutia Inc., 289 F.3d 1367, 1376 (Fed. Cir. 2002); In re Swartz, 232 F.3d 862, 863 (Fed. Cir. 2000). See Enzo Biochem, Inc. v. Calgene, Inc., 188 F.3d 1362, 1369-75 (Fed. Cir. 1999).

Claim construction is a question of law. See Cybor Corp. v. FAS Techs.,

Inc., 138 F.3d 1448, 1454 (Fed. Cir. 1998) (en banc). Because claims during prosecution must be given their "broadest reasonable interpretation," this Court reviews the USPTO's interpretation of claim language to determine whether it is "reasonable" in light of all the evidence before the Board. In re Morris, 127 F.3d 1048, 1054 (Fed. Cir. 1997).

This Court reviews questions of law de novo, but upholds the Board's fact findings unless they are unsupported by substantial evidence in the record. See In re Hyatt, 211 F.3d 1367, 1372 (Fed. Cir. 2000); Gartside, 203 F.3d at 1315. The substantial evidence standard is "a limited standard of review that only tests whether a determination is supported by 'such relevant evidence as a reasonable mind might accept as adequate to support a conclusion.'" Inland Steel Indus. v. United States, 188 F.3d 1349, 1359 (Fed. Cir. 1999) (quoting Consolidated Edison Co. v. NLRB, 305 U.S. 197, 229 (1938)). See In re Jolley, 308 F.3d 1317, 1320 (Fed. Cir. 2002). "[T]he possibility of drawing two inconsistent conclusions from the evidence does not prevent an administrative agency's finding from being supported by substantial evidence." Consolo v. Federal Maritime Comm'n, 383 U.S. 607, 620 (1966); see also Gartside, 203 F.3d at 1312.

B. Rostoker Discloses Aluminum Oxide Particles Having Size Ranges That Overlap The Two Size Ranges Kumar Claims

Kumar very broadly claims a collection of very small aluminum oxide particles with two size limitations: (i) average diameter and (ii) particle size distribution. Substantial evidence in Rostoker supports the Board's findings that Rostoker discloses a preferred particle size (average diameter) and a preferred range of particle sizes (particle distribution) that overlap Kumar's claimed particle size limitations, as well as the Board's conclusion of obviousness.

1. Rostoker Teaches Kumar's Particle Size Limitation

Kumar's representative claims 1 and 19 claim extremely small aluminum oxide particles that have a range of sizes (diameters) wherein the average diameter (particle size) ranges from about 5 to 500 nanometers (nm). A31-32. These aluminum oxide nanoparticles are used, for example, to polish the surfaces of semiconductors. A04.

Kumar concedes that his claimed particle average diameter limitation overlaps that of Rostoker. A490 (2nd paragraph). The Board also found that Kumar conceded that Rostoker discloses the claimed average diameter range. A05.

Rostoker teaches methods for polishing semiconductor substrates. In

particular, Rostoker describes a polishing slurry including an aluminum oxide product very similar to that of Kumar's claimed invention with particles that have a preferred size of "X" nanometers, ranging between 10-100 nm, and preferably no greater than 50 nm. A605, A607 (claim 10). Thus, Rostoker's disclosed preferred particle size unambiguously overlaps Kumar's claimed particle size, wherein the aluminum oxide particles have an average diameter of about 5 to 500 nm. A02, A504, A506. Accordingly, substantial evidence of record supports the Board's finding that Rostoker expressly teaches the average particle size limitation of Kumar's representative claims 1 and 19.

2. Rostoker Also Teaches Kumar's Particle Distribution Limitation

Kumar second limitation is directed to aluminum oxide particles that have a narrow particle size distribution (PD) for improved polishing. In Kumar's Claim 1, the narrow particle distribution is limited such that approximately only one in one million particles will have a diameter larger than three times (3x) the average particle diameter (AD). A02, A504. In his Claim 19, the narrow PD is limited such that approximately 95% of the particle diameters of the collection of particles fall within the range of 40% to 160% of the AD. A02, A506. In each case, this particle distribution is dependent upon the average diameter.

This particle distribution is illustrated by the examples provided by the

Board. The Board provided two separate examples of Kumar's claimed PD using 10 nm and 100 nm average diameters from within Kumar's claimed average diameter range. A013-14. With respect to Claim 1, using a 10 nm average diameter, the Board found that Kumar claimed a particle distribution range of about 0-30 nm (3 x 10 nm). With respect to Claim 19, using a 10 nm average diameter, the Board found that Kumar claimed a particle distribution range of about 4-16 nm (10 nm x 0.4 = 4 nm, 10 nm x 1.6 = 160 nm). A013. In its second example, this time using a 100 nm average diameter, the Board found that Kumar claimed a particle distribution range of 0-300 nm (3 x 100 nm) for claim 1, and a particle distribution range of 40-160 nm (100 nm x 0.4, 100 nm x 1.6) for claim 19. A014.

Rostoker describes a polishing slurry including an aluminum oxide product with particles that have a distribution of particle sizes controlled to within "Y" nanometers, which is a percentage of the value of "X," and is preferably no greater than 50% of "X" to ensure a narrow Gaussian distribution of particle sizes about "X." A605; A607 (claim 10). Rostoker further describes a quality factor "Q," a measure of particle size distribution, that is inversely proportional to "Y." As explained previously, "Q" is the ratio of particle concentrations at "X" divided by the particle concentration at -X/2 and +X/2. "Q" can range from 10 - 10,000.

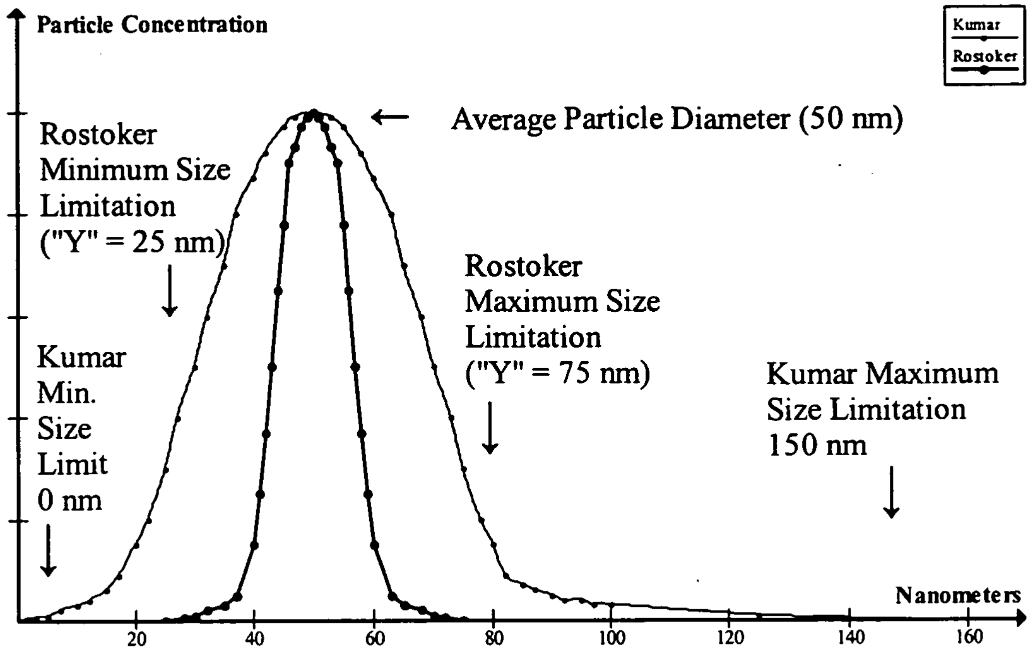
A605. Maintaining a high "Q" range, i.e., a narrow particle size distribution, ensures improved polishing because larger particles tend to scratch the surface to be polished and small particles merely dilute the slurry. A605.

Rostoker's aluminum oxide product is very similar to that of Kumar's claimed invention, where the aluminum oxide particles have particle size distribution where: (i) approximately less than 1 in 10^6 particles has a diameter greater than three times (3x) the AD; or (ii) approximately 95% of the particles fall within the range of 40% to 160% of the AD. A02, A504, A506. As shown below, using a 50 nm AD which is between the Board's examples of 10 nm and 100 nm, Kumar's claimed particle size distribution appears to overlap the particle size distribution described in Rostoker.

Kumar	Rostoker
<u>Claim 1</u> **Particle Average Diameter** = 50 nm (which is between 5 - 500 nm). A504. **Particle Distribution:** Less than 1 in 10^6 particles has diameter greater than 150nm (3 x 50 nm = 150 nm). A504.	**Particle Diameter** = 50 nm (X = 50 nm, which is between 10 - 100 nm, and is equal to the preferred maximum value 50 nm). A605, A607. **Particle Distribution:** Largest particle size is preferably less than 75 nm (Y ≤50% of 50 nm or 25 nm, 75 nm is 50% greater than (150% of) 50 nm (150% x 50 nm = 75 nm)). A605, A607. or **Particle Distribution:** Only 1 in 10,000 particles is larger than 75 nm (Q = 10,000, X = 50 nm, +X/2 = 75 nm). A605.
<u>Claim 19</u> **Particle Average Diameter** = 50 nm (which is between 5 - 500 nm). A505. **Particle Distribution:** 95% of all particles have a diameter between 20 nm and 80 nm (40% x 50 nm = 20 nm, 160% x 50 nm = 80 nm). A505.	**Particle Diameter** = 50 nm (X = 50 nm, which is between 10 - 100 nm, and is equal to the preferred maximum value 50 nm). A605, A607. **Particle Distribution:** Particle sizes are preferably greater than 25 nm and less than 75 nm (Y ≤50% of 50 nm or 25 nm, 25 nm is 50% less than 50 nm, 75 nm is 50% greater than (150%) of 50 nm). A605, A607. or **Particle Distribution:** Only 1 in 10,000 particles is smaller than 25 nm or larger than 75 nm (Q = 10,000, X = 50 nm, -X/2 = 25 nm, +X/2 = 75 nm). A605.

As described in the chart, Kumar's claim 1 requires a particle distribution in which less than one in 1 million particles is three times larger than an average

particle diameter. This is the limitation that eliminates the so-called "tail" that is discussed at length in Kumar's brief (e.g., Br. at 8-9) as well as in the Board's decisions (e.g., A08-09). When given its broadest reasonable interpretation, Kumar claims an overlapping particle distribution where the largest particle size is limited to less than 300% of the average particle size (3 times the average). While Rostoker does not expressly disclose a particle distribution in which less than one in 1 million particles is three times larger than an average particle diameter, as in Kumar's claim 1, Rostoker does explicitly state that the largest preferred particle size is less than 150% (50% greater than) of the average diameter (less than 75 nm in the example of the chart, above). This disclosure alone is enough to render the particle distribution limitation of Kumar's claim 1 obvious, as shown graphically below.

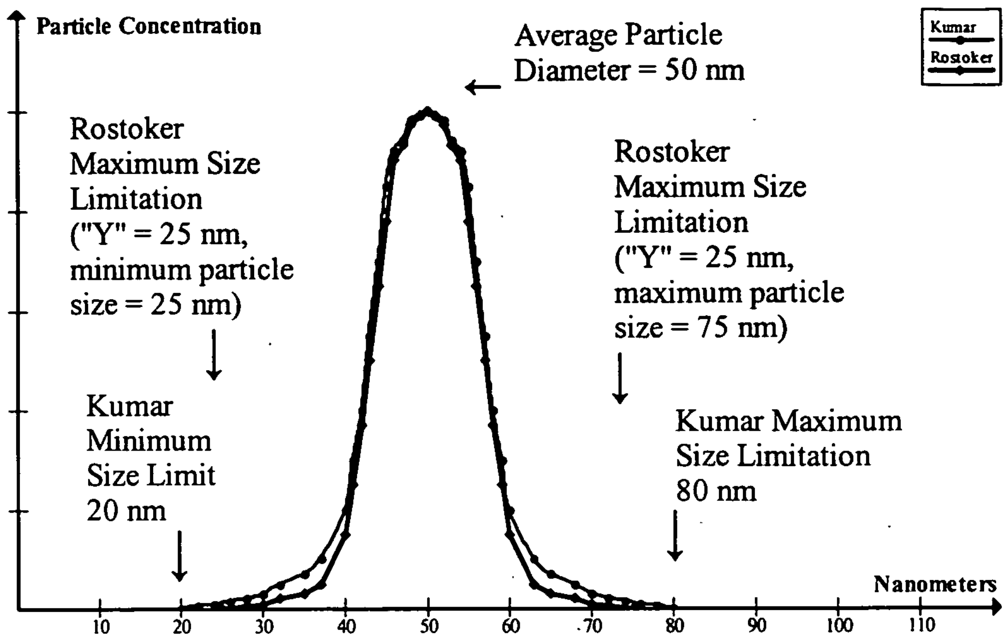


Even so, Rostoker further discloses that its particle distribution may be limited such that less than 1 in 10,000 particles (Q =10,000 in the example of the chart, above) is larger than 150% of the average diameter (75 nm in the example of the chart, above). Moreover, Rostoker expressly suggests that it is important to "ensure a narrow (Gaussian) distribution of particle sizes" (A605, lines 14-15), and that maintaining a narrow particle distribution is necessary because "particles significantly larger than [the average] tend to scratch the surface being polished" (A605, lines 57-59).

Kumar makes no attempt to distinguish his overlapping distribution range, and fails to make any arguments that limiting his distribution to include less than one in 1 million particles greater than 300 % of his average diameter (eliminating

the "tail" of the distribution at large diameters) has any unexpected properties or achieves any unexpected results relative to the Rostoker's disclosed range. See In re Woodruff, 919 F.2d 1575, 1578 (Fed. Cir. 1990). In light of Rostoker's express disclosure that maintaining a narrow particle size distribution improves polishing because larger particles scratch the surface to be polished (A605, col. 7, lines 55-61), he could not do so.

Moreover, as described in the comparative chart (p. 25) for Kumar's claim 19, where the average particle size is 50 nm, Rostoker expressly discloses a preferred particle size distribution between 25 nm - 75 nm, and if Y is equal to 50 % (or 25 nm). Kumar claims an overlapping range of 20 nm - 80 nm where the average particle size is 50 nm. Moreover, Rostoker discloses that only 1 in 10,000 particles would have a size less than 25 nm or greater than 75 nm, where Q is equal to 10,000. Thus, even when Rostoker's maximum "y" value is used, Rostoker expressly discloses the particle distribution limitation of Kumar's claim 19 and renders this limitation obvious, as shown graphically below.



The Board expressly agreed with the patent examiner and found that "Rostoker discloses a collection of particles having both the sizes *and* distribution within appellants' claimed ranges, i.e., Rostoker appears to disclose a collection of particles which do not include a tail." A07-08 (emphasis in original). To further explain its finding, the Board provided several examples showing the overlap of particle size distributions between Rostoker and Kumar. A13-14.

The Board provided examples Kumar's claimed particle size distribution using 10 nm and 100 nm average particle sizes. A013-14. The Board found that Kumar claimed a particle distribution range of 0-30 nm in representative claim 1, and a particle distribution range of 4-16 nm in representative claim 19, using a 10 nm average particle size. A013. In its second example, the Board found that

Kumar claimed a particle distribution range of 0-300 nm in representative claim 1, and a particle distribution range of 40-160 nm in representative claim 19, using a 100 nm average particle size. A014.

In each example the particle size distribution limitations of Kumar's claims 1 and 19 entirely overlapped the particle size distribution computed by the Board from the disclosures of Rostoker. A08, A13-14. The Board further noted that Rostoker's discussion of the "Q" value suggests an "extremely uniform particle size [that does] not include a tail." A09. Thus, the Board identified several bases from which the examiner had established a *prima facie* case of obviousness.

Kumar's arguments regarding the alleged inability to definitively determine a particle size distribution from Rostoker's disclosure and the alleged absence in Rostoker of an overlapping particle size distribution is based on a misunderstanding of the reference and the Board decision, and is not supported by the record. In contrast to Kumar's assertions, the Board clearly explains its decision and the substantial evidence upon which it is based, e.g., see A08-09 and A765-766 (Decision on Request for Reconsideration). Accordingly, the Board's findings regarding the particle size distribution limitations of claims 1 and 19 should be affirmed.

C. Rostoker Is Enabled

Kumar argues Rostoker is not enabled. Br. at 22-29. However, a closer look at Kumar's "enablement" argument shows that it is really just a different way of arguing his earlier point, that Rostoker does not teach Kumar's claimed particle distribution limitation or how one of ordinary skill in the art would get such a particle distribution. Kumar has the burden of showing that Rostoker does not teach one skilled in the art how to make and use aluminum oxide nanoparticles having its disclosed narrow particle size distribution.. See Amgen Inc., v. Hoechst Marion Roussel, Inc., 314 F.3d 1313, 1355 (Fed. Cir. 2003). Kumar did not carry this burden.

Specifically, Kumar argues that Rostoker does not teach one skilled in the art to manufacture aluminum oxide nanoparticles having a narrow particle size distribution. Br. at 22-23, 25-26. Kumar's argument, however, (i) ignores the express findings of the Board, (ii) ignores the express teachings of Rostoker and the Siegel patent incorporated by reference therein, and (iii) appears based on a misreading of the Rostoker and Siegel disclosures as well as the Board's decision.

1. A Patent Is Presumed Valid, Operable and Enabled.

A published patent enjoys a presumption of validity and operability. 35 U.S.C. § 282; University of Rochester v. G.D. Searle & Co., Inc., 358 F.3d 916,

920 (Fed. Cir. 2004). This includes meeting the requirements of 35 U.S.C. § 112 for enablement. Nat'l Recovery Techs., Inc. v. Magnetic Separation Sys., Inc., 166 F.3d 1190, 1195 (Fed. Cir. 1999). The presumption of validity can only be overcome by clear and convincing evidence. G.D. Searle, 358 F.3d at 920. The burden of proving Rostoker invalid falls solidly on Kumar.

Rostoker, in claim 10, claims aluminum oxide particles within Kumar's claimed size range and particle size distribution. Rostoker not only claims and discloses these aluminum oxide particles, it also discloses a method for producing them. A604 (col. 6, ll. 32-50, discussing Siegel). Nothing further is required of Rostoker to show that it is an enabled prior art reference, and to render Kumar's claimed invention obvious, unless Kumar produces clear and convincing proof of inoperability of Rostoker's disclosed method to produce the claimed aluminum oxide particles. The Board properly found that Kumar did not meet its burden. A767-768.

2. Enablement Merely Requires that Rostoker Place Its Invention in the Possession of the Public

In order to be valid prior art for the purposes of 35 U.S.C. § 103, a reference must disclose the invention and "enable" the public to practice the invention. In re Payne, 606 F.2d 303, 314-15 (CCPA 1979). In other words, in order to be an

enabling reference, a printed publication must teach one skilled in the art how to make and use the claimed invention without undue experimentation. See Elan Pharmaceuticals, Inc. v. Mayo Found. for Medical Educ. and Research, 346 F.3d 1051, 1054-57 (Fed. Cir. 2003); Amgen, 314 F.3d at 1354-55; Minnesota Mining and Mfg. Co. v. Chemque, Inc., 303 F.3d 1294, 1306 (Fed. Cir. 2002).

Thus, a patent is enabling for § 103 purposes if one skilled in the pertinent art using the description in the patent, combined with his or her own knowledge of the particular art, would be in possession of the claimed invention. See In re Graves, 69 F.3d 1147, 1152 (Fed. Cir. 1995) quoting In re LeGrice, 301 F.2d 929, 936 (CCPA 1962); In re Donohue, 766 F.2d 531, 533 (Fed. Cir. 1985) ("Such possession is effected if one of ordinary skill in the art could have combined the publication's description of the invention with his own knowledge to make the claimed invention.").

Indeed, even a reference that requires some amount of experimentation by one skilled in the art is nevertheless an enabled anticipatory reference, so long as the experimentation is not "undue." The determination of what constitutes undue experimentation requires the application of a standard of reasonableness, taking into account the nature of the invention and the state of the art. See Johns Hopkins University v. CellPro, Inc., 152 F.3d 1342, 1360-62 (Fed. Cir. 1998); In re Wands,

858 F.2d 731, 736-37 (Fed. Cir. 1988) ("a considerable amount of experimentation is permissible, if it is merely routine, or if the specification in question provides a reasonable amount of guidance with respect to the direction in which the experimentation should proceed.").

Rostoker teaches one skilled in the art how to make and use its claimed aluminum oxide particles. Nothing more is required because Kumar's claims overlap Rostoker's disclosure. Elan Pharmaceuticals, 346 F.3d at 1057. Moreover, the issue is whether Rostoker enables its own claimed invention, not the invention claimed by Kumar. CFMT, Inc., v. Yieldup International Corp., 349 F.3d 1333, 1338 (Fed. Cir. 2003) ("Enablement does not require an inventor to meet lofty standards for success in the commercial marketplace. Title 35 does not require that a patent disclosure enable one of ordinary skill in the art to make and use a perfected, commercially viable embodiment absent a claim limitation to that effect.").

3. The Rostoker Reference Is Enabling Because It Teaches One Skilled in the Art How to Produce Aluminum Oxide Nanoparticles in The Narrow Size Distribution It Describes.

The Rostoker reference enables one of ordinary skill art to produce aluminum oxide nanoparticles within a narrow particle size distribution overlapped by representative claims 1 and 19. Specifically, Rostoker describes

and claims a chemical mechanical polishing slurry including an aluminum oxide product with particles that have a preferred size ranging between 10-100 nm, and preferably no greater than 50 nm. A605, A607 (claim 10). The aluminum oxide product has a distribution of particle sizes controlled to within 50% of the average particle size to ensure a narrow Gaussian distribution. Id. Rostoker also describes a quality factor ranging from 10-10,000 that is the ratio of particle concentrations at the average particle size divided by the particle concentration at plus or minus (+/-) one half the average particle size. A605.

Rostoker also discloses how the described aluminum oxide particles are produced. Rostoker explains that these particles are produced using the method described in U.S. Patent No. 5,128,081 to Siegel et al., which is incorporated by reference into Rostoker. A604 (col. 6, ll. 32-50). Specifically, Siegel describes aluminum oxide nanocrystals, with a size range from 1-100 nm. A805, col. 1, ll. 24-28, 52-54. In particular, Siegel describes production of aluminum oxide crystals with an average particle size of 18 nm. A808, col. 7, ln. 56 - col. 8, ln. 2. The particle size distribution can be controlled to 20-50 nm, using the Siegel method. A806, col. 4, ll. 46-50. In particular, Siegel explains that "catastrophic grain growth" can be avoided, and a grain size less than 60-70 nm produced" using a proper temperature (800 degrees C), and as shown in Siegel's Fig. 5A.

A799, A807, col. 6, ll. 35-42.

Thus, Siegel and in turn Rostoker disclose a process for making aluminum oxide particles with a very small average particle size (less than 100 nm) and a narrow particle distribution (20-50 nm). One of skill in the art would be able to produce the aluminum oxide particles claimed by Rostoker. This is all that is required to enable Rostoker patent, and for Rostoker to render obvious Kumar's claimed invention, because Kumar's claims overlap Rostoker's disclosed collection of particles. Moreover, the Board found that Rostoker is not limited to manufacturing his claimed aluminum oxide particles by the Siegel method (A06), and was indeed enabled (A767-768).

Kumar claims a particle collection overlapping that disclosed by Rostoker. Accordingly the burden was properly shifted to Kumar to show that Rostoker did not enable his own disclosure. Amgen Inc., v. Hoechst Marion Roussel, Inc., 314 F.3d 1313, 1355 (Fed. Cir. 2003) ("a presumption arises that both the claimed and the unclaimed disclosures in a prior art patent are enabled."). Kumar did not carry this burden.

4. The Kambe Declaration Does Not Provide Clear and Convincing Evidence Required to Overcome the Presumption of Validity of Rostoker

The party alleging invalidity bears the burden of proving by clear and convincing evidence that a patent is invalid, i.e., non-enabled. The Board found that the Kambe declaration did not amount to clear and convincing evidence required to invalidate the Rostoker patent. Dr. Kambe's declaration states that none of the references cited by the examiner, including Rostoker, is capable of producing Kumar's claimed narrow particle size distribution, and that he is not aware of any approach for separating nanoparticles into Kumar's claimed narrow particle size distribution. A636, ¶ 7. At best Kambe's declaration (1) simply denies Rostoker's enablement in a conclusory statement, and (2) states that he himself is ignorant of additional ways to make the particles. As set forth previously, the issue is whether Rostoker's is enabled. See Amgen, 314 F.3d at 1354-55. Nowhere does the Kambe declaration state that Rostoker is not operable, i.e., the claimed and disclosed aluminum oxide particles can not be made.

Further, Dr. Kambe's declaration conflicts with the express teachings of Rostoker. As explained above, Rostoker claims and discloses aluminum oxide particles that are overlapped by Kumar's claimed size range and particle size distribution. The Board found that the Kambe declaration failed to address the

teachings of Rostoker and the examiner's *prima facie* case of obviousness based on Rostoker. A09. More importantly, the Board found that the Kambe declaration was "unsupported by any type of evidentiary showing." A09.

Conclusory assertions by experts without an evidentiary basis do not amount to clear and convincing evidence. See Union Carbide Chemicals & Plastics Technology Corp. v. Shell Oil Co., 308 F.3d 1167, 1186 (Fed. Cir. 2002) (Expert's statements of inoperability without record evidence of unsuccessful experimentation linked to the claims at issue "is not evidence of a lack of enablement."); In re Baxter, 656 F.2d 679, 685 (CCPA 1981) (Burden not met by assertions unsupported by objective evidence; it is the burden of party making the assertion to establish that cited reference failed to produce the claimed product). Therefore, the Board's findings as to the Kambe declaration were based on substantial evidence, and should be affirmed.

5. Kumar's Own Method of Making Aluminum Oxide Particles Is Not In Issue

The Board found, based on substantial evidence, that Rostoker teaches at least Kumar's claimed product of aluminum oxide particles. A07-09, A765-66. The Board also found that Kumar's representative claims 1 and 19 are not limited to any method of manufacturing the claimed aluminum oxide particles. A07, A09.

Kumar's claimed aluminum oxide particles are, therefore, rendered obvious by Rostoker, even if Kumar's method of producing those particles may not be. Vanguard Prods. Co. v. Parker Hannifin Corp., 234 F.3d 1370, 1372 (Fed. Cir. 2000) ("A novel product that meets the criteria of patentability is not limited to the process by which it was made.") (citing 3 Donald S. Chisum, Chisum on Patents § 8.05, at 8-79 (2000). As explained in Minnesota Mining & Manufacturing Co. v. Blume, 684 F.2d 1166, 1173 (6th Cir. 1982) *cert. denied*, 460 U.S. 1047, 103 S.Ct. 1449 (1983) and Beckman Instruments, Inc., v. LKB Produkter AB., 892 F.2d 1547, 1551 (Fed. Cir. 1989), even if inoperative, a reference is prior art for all it teaches to one of skill in the art. See McGinley v. Franklin Sports, Inc., 262 F.3d 1339, 1361(Fed. Cir. 2001) quoting In re Fritch, 972 F.2d 1260, 1264 (Fed. Cir. 1992) ("It is well settled that a prior art reference is relevant for all that it teaches to those of ordinary skill in the art."); Symbol Technologies, Inc. v. Opticon, Inc., 935 F.2d 1569, 1578 (Fed. Cir. 1991). Thus, what is relevant here is the Rostoker's composition, not Kumar's method of the same aluminum oxide particles.

D. The Board Properly Declined to Consider the Untimely Singh Declaration Because It Was First Presented On Request For Rehearing

The Board reviewed, but declined to consider the declaration submitted by

Dr. Singh, citing 37 C.F.R.§ 1.195. The Singh declaration, was first presented with Kumar's Request For Rehearing on April 28, 2003. However, the Singh declaration was executed on December 10, 2001 (A750), over 16 months before Kumar's Request for Rehearing was filed (A730), over one year after the Examiner's Answer was filed in the Appeal before the Board (A678) and before the Board issued its initial decision (on February 27, 2003 (A01)). The Board found that the declaration could have, and should have been submitted earlier on the record before the USPTO - "appellants have failed to provide a showing of good and sufficient reasons as to why this declaration was not earlier presented." A766. Rule 1.195 explicitly sets out the conditions under which an affidavit filed after an appeal will be accepted into evidence: "Affidavits, declarations, or exhibits submitted after the case has been appealed will not be admitted without a showing of good and sufficient reasons why they were not earlier presented." 37 C.F.R. § 1.195; In re Nielson, 816 F.2d 1567, 1569 (Fed. Cir. 1987); In re Rothermel, 276 F.2d 393, 395 (CCPA 1960).

Not withstanding Kumar's contrary assertions, the Board properly found no "good and sufficient reasons" why the Singh declaration should be considered. A766. Kumar argues that the Board presented new evidence in the form of it's appendix to its decision on appeal (see A013), and they should be allowed to do

the same. Br. at 17. However, as explained by the Board, its examples were not new evidence, but merely for Kumar's reference as an aid to understanding the Board's findings. A08, n.3. Further, here, both the examiner and the Board considered the evidence of record and apprised Kumar that the evidence of record was not a sufficient rebuttal of the obviousness rejections of record. The Board's further explanation of its reasoning, and in support of the examiner's decision, certainly does not amount to a new ground of rejection. In re DeBlauwe, 736 F.2d 699, 706 n.9 (Fed. Cir. 1984). Moreover, the Singh declaration which was originally submitted in a different application (see A735), does not even refer to the Rostoker patent at issue (see A743-750), and was originally submitted in the different application on December 10, 2001 - almost 16 months prior to Kumar's request for reconsideration. Kumar has provided no reason why the Singh declaration could not have been submitted earlier.

Kumar's argument that Rule 1.195 is contrary to the Administrative Procedures Act (APA) and 5 U.S.C. § 554 is entirely without merit. Decisions by the Board are required to be based on substantial evidence in the USPTO record prepared by the examiner and before the Board for evaluation. These decisions are reviewed by this Court on that record. Gartside, 203 F.3d at 1313. To allow submission of evidence, after an administrative hearing, except in exceptional

circumstance or based on new evidence, would frustrate review of the Board's decision on the record by this Court. Therefore, the Board's finding that Kumar did not make a showing of "good and sufficient reasons" for the delay in filing the Singh declaration is based on substantial evidence and should be affirmed.

Conclusion

Substantial evidence supports the Board's determination that Rostoker, an enabling reference, renders obvious Kumar's claims, because it discloses aluminum oxide particles having sizes that overlap the claimed ranges. Accordingly, this Court should affirm the Board's decision.

Respectfully Submitted,

May 5, 2004

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CERTIFICATE OF COMPLIANCE

I certify that the foregoing BRIEF FOR APPELLEE DIRECTOR OF THE UNITED STATES PATENT AND TRADEMARK OFFICE complies with the type-volume limitation pursuant to Fed. R. App. P. 32(a)(7)(B) and the Federal Circuit Rule 32(b). The total number of words in the foregoing brief is 8,999 as calculated by the Word Perfect 9.0 program.

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CERTIFICATE OF SERVICE

I hereby certify that on May 5, 2004, I caused two copies of the foregoing BRIEF FOR APPELLEE DIRECTOR OF THE UNITED STATES PATENT AND TRADEMARK OFFICE to be transmitted via FEDERAL EXPRESS addressed as follows:

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BRIEF FOR APPELLEE DIRECTOR OF THE UNITED STATES PATENT AND TRADEMARK OFFICE

United States Court of Appeals
for the Federal Circuit

04-1074
(Serial No. 09/136,483)

IN RE SUJEET KUMAR, HARIKLIA DRIS REITZ, XIANGXIN BI AND NOBUYUKI KAMBE

Appeal from the United States Patent and Trademark Office,
Board of Patent Appeals and Interferences

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May 5, 2004

Representative claims 1 and 19:

1. A collection of particles comprising aluminum oxide, the collection of particles having

(i) an average diameter of primary particles from about 5 nm to about 500 nm and

(ii) less than about one in 10^6 particles have a diameter greater than about three times the average diameter of the collection of particles.

19. A collection of particles comprising aluminum oxide, the collection of particles having

(i) an average diameter from about 5 nm to about 500 nm and

(ii) a distribution of particle sizes such that at least about 95 percent of the particles have a diameter greater than about 40 percent of the average diameter and less than about 160 percent of the average diameter.

A504, A506 (lower roman numerals added).